Nº 12,326 A.D. 1898

Date of Application, 1st June, 1898
Complete Specification Left, 4th Apr., 1899—Accepted, 1st July, 1899

PROVISIONAL SPECIFICATION.

Improvements in Apparatus Employed in Wireless Telegraphy.

We, Guglielmo Marconi, Electrician, and The Wireless Telegraph and Signal Co. Ld., both of 28, Mark Lane, in the City of London, do hereby declare the nature of this invention to be as follows:—

In the Specification of a former Patent granted to me No. 12039 of 1896 I described a receiver in which the ends of an imperfect contact in a local circuit were connected one to earth and the other to an insulated conductor.

According to this invention the conductor is no longer insulated but is connected to earth through the primary of an induction coil whilst the ends of the imperfect contact are connected to the ends of the secondary one of the connections passing through a condenser.

The induction coil preferably consists of a few turns of insulated wire. Over or under this first winding which constitutes the primary is wound a secondary winding which constitutes the secondary. The induction coil should preferably be of thin wire. I have obtained satisfactory results with a coil constituted of 100 turns of copper wire .0060 of an inch in diameter insulated with silk as primary, and 150 turns of similar wire .0048 of an inch in diameter as secondary, the diameter of the coil being .4 of an inch. It is desirable that the primary and secondary windings of the coil should be close to each other.

It is desirable that the induction coil should be in tune or symphony with the electrical oscillation transmitted the most appropriate number of turns and most appropriate thickness of wire varying with the length of wave of the oscillation transmitted..

The capacity of the condenser should be varied (in order to obtain best effects) if the length of wave is varied.

It is desirable that the conductor connected should offer a large surface and therefore the use of such materials as broad wire netting in lieu of wire is desirable.

It is also desirable to employ thick conductors or netting or its equivalents at the transmitting end.

The introduction of the coil in the conductor not only improves the signals but also prevents to a great extent any interference due to atmospheric influences.

Any stray interference can be further minimised by substituting a suitable capacity to the earth.

Dated this 31st day of May 1898.

G. MARCONI.
THE WIRELESS TELEGRAPH AND
SIGNAL COMPANY LIMITED.
G. Marconi,
H. Jameson Davis,
Directors.
Henry W. Allen,
Secretary.

[*Price* 8*d*.]

COMPLETE SPECIFICATION.

Improvements in Apparatus Employed in Wireless Telegraphy.

We, GUGLIELMO MARCONI, Electrician, and THE WIRELESS TELEGRAPH AND SIGNAL COMPANY LIMITED, both of 28, Mark Lane, in the City of London, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:—

In the Specification of a former Patent granted to Guglielmo Marconi No. 12039 of 1896, a receiver is described in which the ends of an imperfect contact in a local circuit were connected, one to earth and the other to an insulated conductor.

According to this invention the conductor is connected to earth or to a suitable capacity through the primary of an induction coil or transformer whilst the ends of the imperfect contact are connected to the ends of the secondary, one of the connections passing through a condenser. The effect of electrical oscillations on the imperfect contact seems to increase very greatly with their E. M. F. and not with their quantity. The object of this invention is to increase the E. M. F. of the received oscillations by transforming up their E. M. F. at the expense of the quantity. This greatly increases the distance over which, at parity of other conditions it is possible to transmit and receive messages.

It is found that if the induction coil or transformer is wound with the ordinary wire used for bobbins or induction coils it fails to work, and its adoption would, instead of improving, greatly reduce the effectiveness of the apparatus, and when the induction coil is wound with very thin wire it only then becomes effective provided it is wound on a nucleus of suitable diameter. The number of turns of each winding and the number of layers must also be carefully determined. If the coil is much longer than two centimetres it is found that unless the secondary is wound in several sections the two windings must be each in one single layer, but if the coil is less than 1 c/m long it is advantageous that the primary and secondary windings should be in several layers. It has also been noticed that it is an advantage if the number of turns is diminished in each layer as the distance from the primary increases.

The introduction of this induction coil not only improves the signals but also prevents to a great extent any interference which might be caused by electrical atmospheric influences.

Figure 1 is a diagram of the arrangement preferred.

Figure 2 shows a modification.

Figures 3 to 10 are diagrams of various forms of induction coil.

In Figure 1, *a* is a long conductor suspended in the air by insulators, and *b* is a connection to earth or other suitable capacity.

*b*¹ is the local battery and *k* is the relay working a signalling or other instrument the arrangements being similar to those described in the former specification.

c is the primary of the induction coil or transformer whch is inserted between *a* and *b* and *d* is the secondary.

e is a condenser placed across the sensitive imperfect contact and the secondary winding of the induction coil or transformer.

f f are choking coils, their object being to prevent the oscillations generated in the winding *d* from running into the battery connections at *h* and *i*, which would weaken the effect of the oscillations on the sensitive imperfect contact *j*.

Figure 2 shows a somewhat similar arrangement which however, does not give quite such good results as Figure 1.

One plate of the condenser consists of 3 plates of copper foil 3.75 × 2.5 cms. The other consists of two plates of the same dimensions separated by paraffin paper .015 c.m. in thickness.

When using the above described induction coil or transformer there is usually employed as the vertical wire at each station a conductor formed of seven strands of about 1 millimetre diameter copper wire 140 feet long, the top of the conductor being about 100 feet from the ground.

In some cases in lieu of the above described conductor a galvanised iron netting about 2 feet broad and 130 feet long, may be employed, the top of the netting being about 110 feet above the ground.

Figures 3 to 10 are diagrams of various forms of induction coil. P is the primary and S the secondary. The primary is to distinguish it from the secondary shown as a thick line although usually the wires of both are of exactly the same diameter.

The diagrams are greatly enlarged half longitudinal sections but are not strictly to scale. In place also of showing the section of each coil or layer of wire as a longitudinal row of dots or small circles as it would actually appear it is for simplicity shown as a single continuous longitudinal straight line. A is the end of the primary which is connected to the aerial conductor *a* and E is the end connected to earth or a capacity. J is the end of the secondary which is directly connected to the sensitive tube or imperfect contact *j* and C is the end which is connected to it through the condenser. G is a glass tube on which the coils are wound.

The wires are insulated by a single covering of silk.

The following table gives particulars of coils which have been successfully used:—

Figure in Drawings.	Diameter of Tube G in centimetres.	Diameter of Wires in centimetres.		Resistance in Ohms.		Number of Turns in Windings.		Length in centimetres.
		Primary.	Secondary.	Primary.	Secondary.	Primary.	Secondary.	
Fig. 3	·935	·01	·01			2 layers of 160 turns each in parallel.	3 sections of 10, 12, 10 layers with 150 45 40 45 40 39 40 35 37 35 30 35 30 25 33 25 20 29 20 15 25 15 12 21 17 5 15 14 10 5 turns—	2.5
Fig. 4	·937	·012	·012			2 layers of 160 turns each in parallel.	4 sections of 9 layers each with 40 | 80 | 40 35 | 35 | 35 | 35 30 | 30 | 30 | 30 27 | 27 | 27 | 27 23 | 23 | 23 | 23 20 | 20 | 20 | 20 15 | 15 | 15 | 15 10 | 10 | 10 | 10 5 | 5 | 5 | 5 turns—	4.0

Figure in Drawings.	Diameter of Tube G in centimetres.	Diameter of Wires in centimetres.		Resistance in Ohms.		Number of Turns in Windings.		Length in centimetres.
		Primary.	Secondary.	Primary.	Secondary.	Primary.	Secondary.	
Fig. 5	·937	·011	·011	4·8	61	2 layers of 160 turns each in parallel.	2 sections of 15 layers each with 153 60 63 50 50 40 40 35 35 33 33 30 30 27 27 24 24 23 22 17 18 15 15 10 10 6 6 2 2 turns—	2·5

Figure in Drawings.	Diameter of Tube G in centimetres.	Diameter of Wires in centimetres.		Resistance in Ohms.		Number of Turns in Windings.		Length in centimetres.
		Primary.	Secondary.	Primary.	Secondary.	Primary.	Secondary.	
Fig. 6.	·975	·012	·012			2 layers of 110 each in parallel.	12 layers of 100 80 75 60 50 45 40 28 20 15 10 5 turns	1·8

Figure in Drawings.	Diameter of Tube G in centimetres.	Diameters of Wires in centimetres.		Resistance in Ohms.		Numbers of Turns in Windings.		Length in centimetres.
		Primary.	Secondary.	Primary.	Secondary.	Primary.	Secondary.	
Fig. 7	·975	·012	·012			4 layers 80 turns } in series 78 ,, } 76 turns } in series 72 ,, }	16 layers of 60 54 46 42 40 36 32 29 26 23 20 18 14 12 9 7 turns	1·5

Figure in Drawings.	Diameter of Tube G in centimetres.	Diameters of Wires in centimetres.		Resistance in Ohms.		Number of Turns in Windings.		Length in centimetres.
		Primary.	Secondary.	Primary.	Secondary.	Primary.	Secondary.	
Fig. 8	·975	·012	·012	5·75	28·5	One layer of two wires in parallel with 160 turns each wound tandem.	3 layers of 310, 45, 45 turns	5·8
Fig. 9	·975	·012	·012	3·2	30	One layer of three wires in parallel with 160 turns each.	1 layer of 500 turns	7·8
Fig. 9	·935	·012	·012	2·8	23	One layer of three wires in parallel with 140 turns each.	1 layer of 420 turns	8·1
Fig. 10	·93	·012	·012	4·9	22	One layer of two wires in parallel with 160 turns each.	1 layer of 400 turns	7·8
Fig. 10	·7	·012	·005	3·75	100	One layer of two wires in parallel with 170 turns each.	1 layer of 680 turns	7·48

Figure 3 shows the arrangement which generally gives the best results.

It is found desirable to connect direct to the tube (not through the condenser) the end of the secondary which is furthest away from the nucleus.

The condenser *e* may be omitted but in that case the results obtained are far less satisfactory.

A capacity may be substituted for the earth connection or a condenser introduced into the earth connection.

The special induction coils shown at Figures 3 to 8 form the subject of another application No. 6982 dated 1st April 1899 and are not claimed *per se* in this specification.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Connecting the conductor to earth through the primary of an induction coil or transformer, and connecting the ends of the imperfect contact to the ends of the secondary, one of the connections being through a condenser.

2. Connecting the conductor to earth through the primary of an induction coil or transformer and the ends of the imperfect contact to the ends of the secondary and also to choking coils the other ends of which are connected to the local circuit.

3. Connecting the conductor to earth through the primary of an induction coil or transformer and the ends of the imperfect contact to the ends of the secondary both the primary and secondary being of wire not exceeding one fortieth of a centimetre in diameter.

4. Connecting the conductor to earth through the primary of an induction coil or transformer and the ends of the imperfect contact to the ends of the secondary, both the primary and secondary being wound in a single layer.

5. In apparatus such as is referred to in the preceding claims, substituting a capacity for the earth.

6. Apparatus substantially as described and illustrated in Figures 1 and 2 of the drawings.

7. Induction coils substantially as described and illustrated in Figures 9 and 10 of the drawings.

Dated this 30th day of March 1899.

G. MARCONI.
Carpmael & Co.,
Agents for the Applicants.

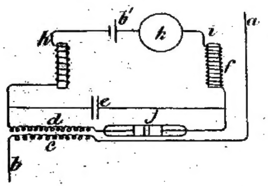
Redhill: Printed for Her Majesty's Stationery Office, by Malcomson & Co., Ltd.—1899.

A.D. 1898. June 1. N° 12,326.
MARCONI & others' Complete Specification

(2 SHEETS)

SHEET 1.

Fig. 1.



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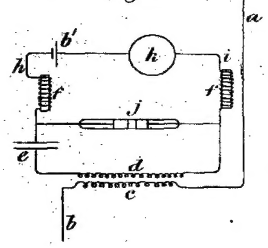

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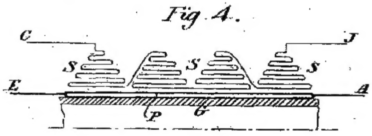
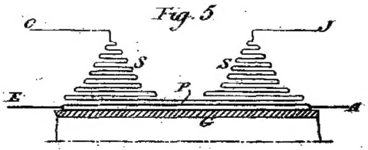


Fig. 5



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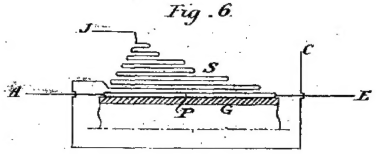

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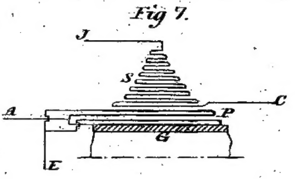

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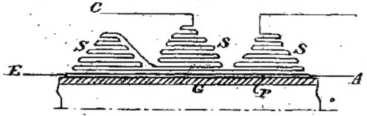

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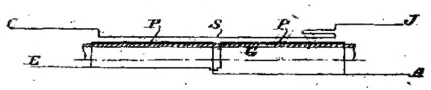


Fig. 9.

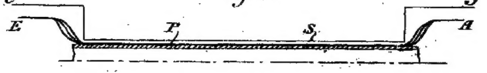
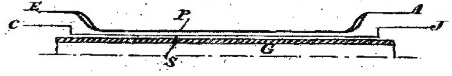


Fig. 10.



[This Drawing is a reproduction of the Original on a reduced scale]

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A.D. 1898. JUNE 1. No. 12,326.

MARCONI *& others'* COMPLETE SPECIFICATION

SHEET 1.

Fig. 1.

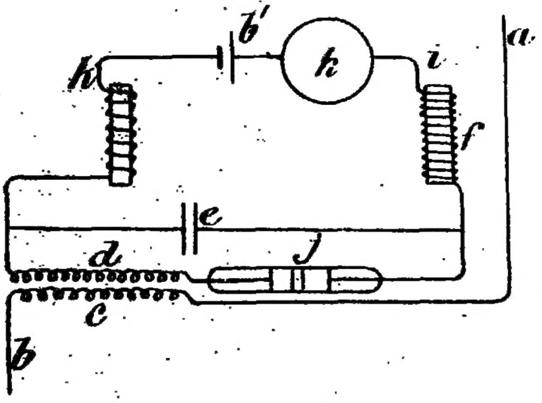
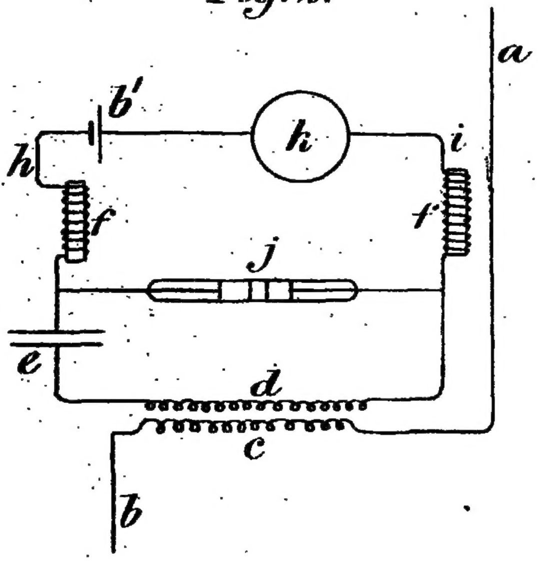
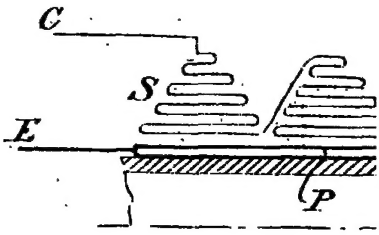
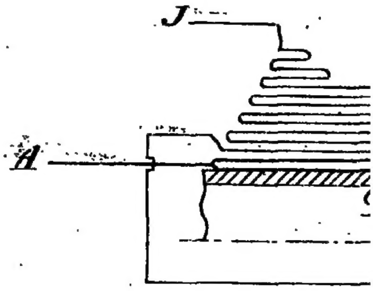
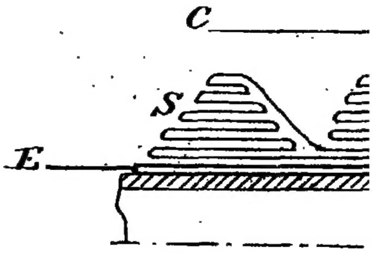


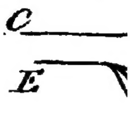
Fig. 2.











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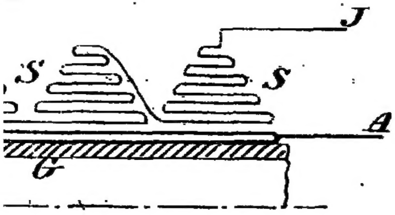
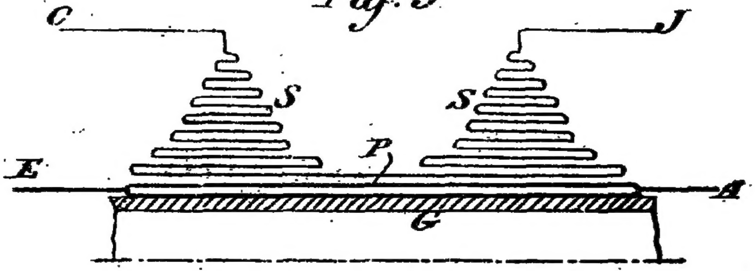


Fig. 5



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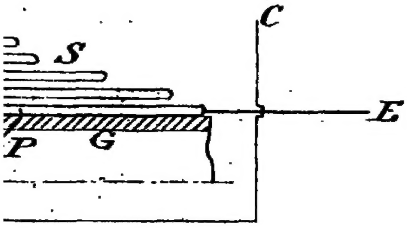

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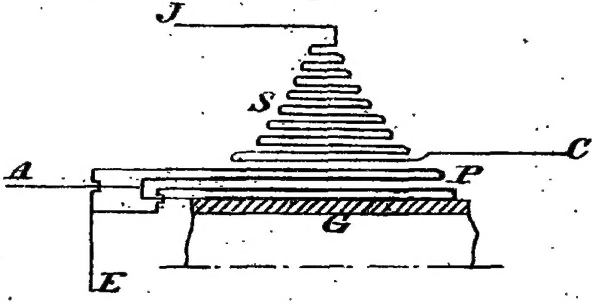
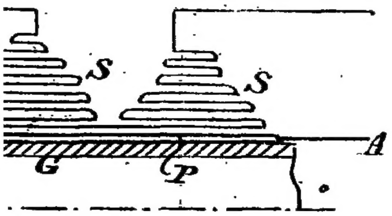


Fig. 3.



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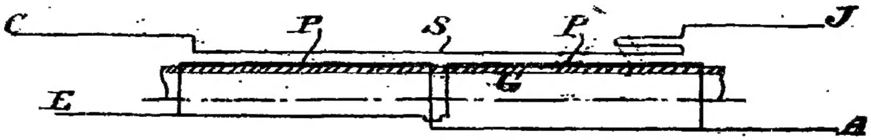

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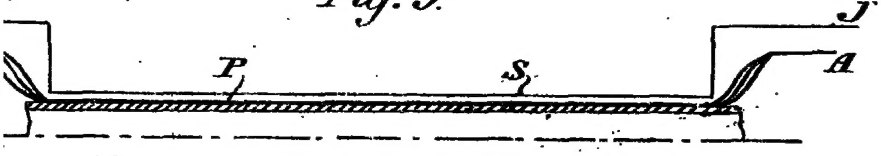

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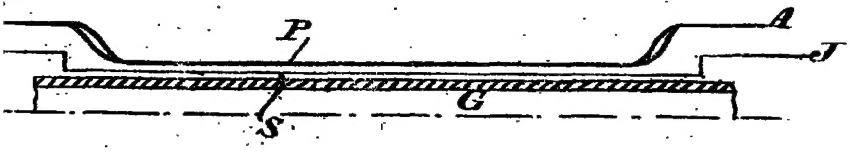

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